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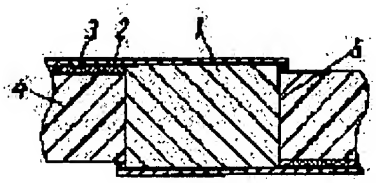
(54) CONDUCTIVE PASTE AND ITS MANUFACTURE

(57)Abstract:

PURPOSE: To provide conductive paste and its manufacturing method for circuit connection between layers in a printed wiring board, which is excellent in filling property, conductivity and cost reduction.

CONSTITUTION: A through hole 5 of a board 4 is filled with copper paste 1 and it is hardened. The copper paste is formed by kneading binder, spherical copper powder whose grain diameter is 1.0-2.5μm and spherical copper powder whose grain diamer is 20-40μm.



LEGAL STATUS

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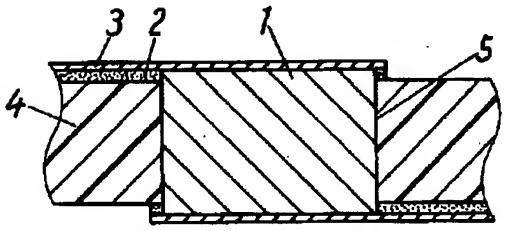
CLAIMS

[Claim(s)]
[Claim 1] The conductive paste whose particle size kneaded and constituted to the binder the spherical copper powder and the 20-40-micrometer spherical copper powder which are 1.0-2.5 micrometers as a conductive particle.
[Claim 2] The conductive paste according to claim 1 whose particle size uses 20-40-micrometer spherical copper powder 0.5 to 0.6% of the weight to the spherical copper powder which is 1.0-2.5 micrometers.
[Claim 3] The conductive paste according to claim 1 which uses an epoxy resin as a binder.
[Claim 4] The manufacture approach of the conductive paste which carries out addition distribution of the 20-40-micrometer spherical copper powder after particle size carries out kneading distribution of the spherical copper powder and the epoxy resin which are 1.0-2.5 micrometers.

[Translation done.]

Drawing selection Representative drawing

1 銅ペースト
2 銅 箔
3 銅めっき
4 基 材
5 スルーホール



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the conductive paste usable to circuit connection etc. and its manufacture approach between the layers in a printed wired board.
[0002]
[Description of the Prior Art] In recent years, the high density of a printed wired board and highly precise-ization are strongly demanded with rapid development of the information-machines-and-equipment field. In this, the copper-plating through hole was in use as an electrical connecting means between layers. However, the substrate which can apply a plating method of construction is limited to what has good dimensional accuracy, such as glass epoxy group material. Although the silver paste is used for the phenol base material, since there is a characteristic problem of silver migration in a silver paste, there is a limitation in application to a high-density substrate.
[0003] On the other hand, as a technical trend of through hole formation, it is filled up with a conductive paste in a copper-plating through hole, and the approach (copper-plating through hole substrate) of making it into a blind hole is proposed by JP,5-129781,A by giving copper plating to the both ends. The through hole section does not serve as a through tube, but this approach is smooth, and since it can form a components pad on a through hole, it can be greatly contributed to improvement in a wiring consistency.
[0004]
[Problem(s) to be Solved by the Invention] However, by the above-mentioned approach, since it is necessary to perform copper plating twice, the technical problem that it becomes a cost rise occurs. Therefore, a method of construction and a conductive paste excellent in the cost performance for attaining high density and highly precise-ization were demanded strongly.
[0005] This invention aims at offering the conductive paste excellent in restoration nature, conductivity, and the cost force, and its manufacture approach in order to solve said conventional technical problem.
[0006]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the conductive paste of this invention kneads and constitutes to a binder the spherical copper powder and the 20-40-micrometer spherical copper powder whose particle size is 1.0-2.5 micrometers as a conductive particle.
[0007]
[Function] According to the configuration of above mentioned this invention, a conductive high paste with easy and restoration is obtained. Since it is not necessary to give copper plating in a through hole by using this copper paste, a printed wired board with high dependability with the cost force (copper paste through hole substrate) is realizable.
[0008]
[Example] Hereafter, the example of this invention is explained.
[0009] Copper powder attracts attention as an ingredient of the stability of a price, and outstanding

electrical characteristics as a conductive paste. There are that they are the fines (usually - 3 micrometers or less) which have moderate particle size distribution as a property required of the copper powder as a paste ingredient, excelling in dispersibility, it being the configuration (the shape of a grain being desirable) which is easy to carry out mutual contact, and oxidation resistance, and it is indicated by JP,5-57324,B that it is a high grade etc. In this, the manufacturing method of copper powder with a mean particle diameter of 0.97 micrometers - 1.82 micrometers is indicated. This invention is begun by carrying out the amount addition of limitation of the copper powder of the diameter of a large drop limited to the copper powder of the limited diameter of a granule not using the copper powder of the diameter of a single particle, and extending particle size distribution, and restoration is easy in a through hole, and it is based on having found out that the conductive paste in which the property excellent in conductivity is shown was obtained.

[0010] In said configuration, it is desirable that it is 20-40 micrometers as spherical copper powder of the diameter of a granule as spherical copper powder of 1.0-2.5 micrometers and the diameter of a large drop. As for the addition of the spherical copper powder of the diameter of a large drop, it is desirable that it is 0.5 - 0.6 % of the weight to the diameter copper powder of a granule.

[0011] If particle size is less than 1 micrometer, kneading distribution is difficult, and if it is 2.6 micrometers or more, it will be hard to attain the closest packing. If the addition of the copper powder of the diameter of a large drop is less than 0.5 % of the weight, the conductive improvement effectiveness will not be seen. Conversely, if it is 0.7 % of the weight or more, the surface roughness of a paint film will become large and restoration into a through hole will become difficult.

[0012] After the manufacture approach of the conductive paste of this invention carries out kneading distribution of the spherical copper powder and the binder of the diameter of a granule, it is characterized by carrying out addition distribution of the spherical copper powder of the diameter of a large drop. It becomes possible to hold the optimal particle size distribution by this.

[0013] In said configuration, the point that hardening contraction is small as a binder to an epoxy resin is desirable.

[0014] Hereafter, a concrete example is explained with the example of a comparison.

(Example 1) The example 1 of this invention is hereafter explained based on drawing 1 . Drawing 1 is the type section Fig. of the copper paste through hole substrate of an example 1, and, for a copper paste and 2, as for copper plating and 4, copper foil and 3 are [1 / a base material and 5] through holes. The thickness of copper foil 2 is [the thickness of 15 micrometers and a base material 4 of the thickness of 18 micrometers and copper plating 3] 0.2mm, and the quality of the material is glass epoxy. The diameter of a through hole 5 is 0.35mm. The copper paste 1 was produced as follows. Kneading distribution of the spherical copper powder 100 weight section with a mean particle diameter of 2 micrometers and the epoxy resin (Epicoat 828 oil-ized shell epoxy company make) 11 weight section is fully carried out using a kneader and 3 rolls. Next, the spherical copper powder 0.57 weight section with a mean particle diameter of 25 micrometers is added, and kneading distribution is carried out with 3 rolls.

[0015] Furthermore, 5.5 weight sections addition of the curing agent (friend cure PN-23 Ajinomoto Co., Inc. make) was carried out, kneader kneading was carried out and the copper paste 1 was obtained. The obtained copper paste 1 was filled up with and hardened to the through hole 5. The copper-plating layer was formed on copper foil 2 and a through hole 5 after polish. Through hole resistance was 1mohm / hole.

[0016] (Example 1 of a comparison) In the example 1, the through hole substrate was similarly produced except carrying out 100.57 weight sections use only of the spherical copper powder with a mean particle diameter of 2 micrometers, without adding spherical copper powder with a mean particle diameter of 25 micrometers. Through hole resistance was 1.8mohm / hole.

[0017] (Example 2 of a comparison) In the example 1, the through hole substrate was similarly produced instead of spherical copper powder with a mean particle diameter of 2 micrometers with a mean particle diameter of 4 micrometers except carrying out spherical copper powder 100 weight section use.

[0018] Through hole resistance was 2.5mohm / hole.

(Example 3 of a comparison) In the example 1, the through hole substrate was similarly produced except carrying out 1 weight section addition of the spherical copper powder with a mean particle diameter of 25 micrometers. Through hole resistance was 2.3mohm / hole.
[0019] (Example 4 of a comparison) In the example 1, the through hole substrate was similarly produced except using the 16.5 weight sections by the system of phenol resin and a curing agent instead of an epoxy resin. In this case, since it is large compared with an epoxy resin, in order for hardening contraction of phenol resin to perform uniform restoration, the restoration by the phenol resin content copper paste was required twice. Through hole resistance was 0.8mohm / hole.
[0020] (Example 5 of a comparison) In the example 1, the through hole substrate was similarly produced except carrying out kneading distribution of spherical copper powder with a mean particle diameter of 25 micrometers and the spherical copper powder with a mean particle diameter of 2 micrometers with an epoxy resin at coincidence. Through hole resistance was 1.6mohm / hole.
[0021] (Example 2) In the example 1, the through hole substrate was similarly produced except carrying out 0.5 weight section use of the spherical copper powder with 100 weight sections and a mean particle diameter of 35 micrometers for spherical copper powder with a mean particle diameter of 1.5 micrometers. Through hole resistance was 1.1mohm / hole.
[0022] It becomes possible by using the particle design of the copper powder of this invention, a binder design, and a variational method to make through hole resistance small a passage clear from the above example and example of a comparison. By furthermore adopting an epoxy resin, it also has the advantage in which restoration is completed at once.
[0023] And since the restoration nature into a through hole was excellent, in cold storage (-55 degrees C) 1000 hours, it was satisfactory for elevated-temperature preservation (100 degrees C) 1000 hours for various reliability-trials, 100 cycle spalling test (125-degree-C, 30 minute <-->-65 degree-C, 30 minutes), and humidity resistance test (55-degree-C, 95%RH) 1000 hours.
[0024]
[Effect of the Invention] According to this invention, since it becomes possible to reduce a copper-plating process at once, high-reliability and a high density printed wired board with the cost force can be manufactured.

[Translation done.]

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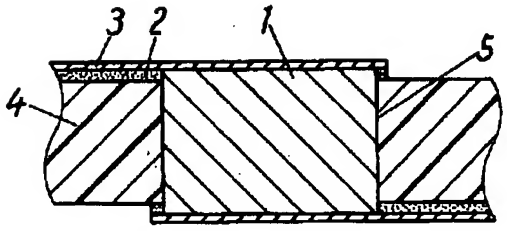

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